PATENT SPECIFICATION

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NO DRAWINGS.

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COMPLETE SPECIFICATION.

Reflective Paint.

I, MINISTER OF AVIATION, LONDON, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to reflective paints.

The most important purpose of a reflective paint is to prevent the excessive heating up of a body to which it is applied when exposed to radiated heat. Solar radiation is typical of the kind of radiation against which a reflective paint should be effective as the surface temperature of the sun may be assumed to be about 6000°K. Solar radiation is spread over a very wide wavelength range and, of course, includes radiation in the ultra violet range.

To be fully effective the paint must reflect radiations of wavelength less than 0.4 microns as well as in the longer wavelengths. About 12% of solar energy is radiated at wavelength less than this value.

The effectiveness of the paint depends on both the binder and the pigment but it is the latter which is the more important.

The common reflecting paints hitherto employed must include white pigments, usually titanium dioxide, but these pigments readily absorb radiations of wavelengths less than 0.4 microns. Hence their effectiveness is severely limited. In fact the maximum practical absolute reflectivity obtainable from a titanium dioxide paint is 76%.

According to the present invention a reflective paint comprises a hardenable liquid medium and finely divided solid titanium pyrophosphate as a pigment.

Advantageously the particles of the pigment are about 0.25 microns in diameter but satisfactory reflectivity is achieved if the particles are in the size range 0.1 to 2.0 microns in diameter.

A suitable liquid medium is one based on nitro-cellulose which is non-absorbent to ultra violet radiations. Other suitable media are based on acrylic resin and are known broadly as acrylates. These are commonly two component crosslinked compositions.

The pigment/medium mixture may be varied within wide limits depending on the mode of application and the number of coats to be applied but a satisfactory proportion for general brush and spray application is 50/50 by volume.

In one example according to the invention the pigment was made as follows. A quantity of concentrated titanium tetrachloride (as a fuming liquid) was diluted with an equal volume of a 50/50 mixture of concentrated hydrochloric acid and water. A slight stoichiometric excess of ortho-phosphoric acid was then added to the diluted titanium tetrachloride so as to precipitate an intermediate compound in gelatinous form which is presumed to be the orthophosphate. This precipitate was filtered and then washed with a 50% solution of hydrochloric acid. The final treatment was heating at 850°C for 3 hours in air which converted the compound to solid titanium pyrophosphate, TiP_2O_7.

As produced the titanium pyrophosphate was an aggregate including lumps of coherent particles and was pulverised by conventional ballmilling. The particles, as analysed by X-ray diffraction, were cubic crystalline with an average side length of about 7.8 A.U. The particle size was in the range 0.1 to 2.0 microns in diameter.

A paint was made by mixing the pigment after ball-milling with a nitro-cellulose based

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medium in 50/50 relationship by volume and with sufficient thinners to reduce the viscosity for brush application. The paint was applied to a test surface to build up a layer about 0.006 in. thick and allowed to dry. The reflectivity of the paint was then measured by a conventional recording spectrographic method in which a comparison was made between the paint and a standard material (magnesium oxide). From this value the reflectivity was found to have an absolute value of about 86% in relation to a source of 6000°K between the wavelengths 0.3 to 2.2 microns.

In a second example a gloss finish paint was made from powdered titanium pyrophosphate pigment, made as in the first example, mixed with a two component cross linked liquid acrylic medium in a proportion of 20% pigment to 80% medium by volume.

Reflectivity tests were carried out as follows. An anodised aluminium test surface was brush-coated with an etching primer and further coated with an undercoat paint made from titanium dioxide mixed with the same acrylic medium and in the same proportions as the gloss paint. The gloss paint was applied by brush on top of the dry undercoat, both paint layers being distributed at the rate of about 2 ozs/sq. yard.

The fully dried paint system was then tested for thermal reflectivity against radiations of wavelengths in the range 0.3 to 2.2 microns from a black body at 6000°K. The integrated reflectivity was about 80% which is much superior to that usually obtained by using only titanium dioxide as the pigment.

It will be seen therefore that the new paints compared with titanium dioxide paints, show an increase in reflectivity which may be as much as about 9% whereby the energy absorbed by the structure protected by the paint is reduced by more than 30%.

It is to be noted that the new paints have widespread application as a protective covering against thermal radiation.

WHAT I CLAIM IS:—

1. A radiation reflective paint composition containing a hardenable resinous liquid carrier based on the group consisting of nitrocellulose and acrylic resins and a pigment of finely divided solid particles of titanium pyrophosphate, the diameter of the particles being in the range 0.1 to 2.0 microns and constituting from 20% to 50% by volume of the paint composition.

2. A paint composition as claimed in claim 1 in which the diameter of the pigment particles has an average value of 0.25 microns.

3. A radiation reflective paint composition including a titanium pyrophosphate pigment as hereinbefore described in either of the examples.

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